What is claimed is:

1. A semiconductor device comprising:

a SiC substrate; and

a heat conductor formed in a hole in the SiC substrate and made of a linear structure of carbon elements.

2. The semiconductor device according to claim 1, further comprising:

a film formed on the SiC substrate;

a hole formed in the film on the heat conductor;

an electrode formed in the hole and directly connected to the heat conductor.

3. The semiconductor device according to claim 2, wherein the electrode is a metal stack film whose lower most layer is a titanium layer.

4. The semiconductor device according to claim 2, wherein, on an entire surface of the SiC substrate opposite to the film, a conductive film electrically connected to the electrode is formed.

5. The semiconductor device according to claim 2, wherein a protective film is formed between the SiC substrate and the film.

6. The semiconductor device according to claim 5, wherein a lattice constant of the protective film is a value between lattice constants of the SiC substrate and the film.

7. A semiconductor device comprising:

a SiC substrate;

a first heat conductor formed in a first hole in one surface of the SiC substrate and made of a linear structure of carbon elements;

a second heat conductor formed in a second hole in the one surface of the SiC substrate to be spaced from the first hole at interval, the second heat conductor being made of a linear structure of carbon elements; and

an element formed on an other surface of the SiC substrate.

8. The semiconductor device according to claim 7, wherein a distance from the other surface of the SiC substrate to an upper surface of the second heat conductor is longer than a distance from the other surface of the SiC substrate to an upper surface of the first heat conductor.

9. The semiconductor device according to claim 7, wherein the element is an HEMT, and at least a part of the second heat conductor is located between a gate electrode and a drain electrode of a HEMT when viewed from above the SiC substrate.

10. A semiconductor device comprising:

a SiC substrate;

a first heat conductor formed in a hole in the SiC substrate and made of a linear structure of carbon elements;

a second heat conductor formed to cover one surface

of the SiC substrate entirely and made of a linear structure of the carbon elements; and

an element formed on an other surface of the SiC substrate.

11. A semiconductor device comprising:

a semiconductor substrate with a thickness of 30 μm or more to 200 μm or less; and

a heat conductor formed in a hole in the semiconductor substrate and made of a linear structure of carbon elements.

12. The semiconductor device according to claim 11, wherein the semiconductor substrate is any of a silicon substrate, a gallium arsenide substrate and a sapphire substrate.

13. A method of manufacturing a semiconductor device comprising:

forming a mask film including a window on one surface of a SiC substrate; and

selectively growing a linear structure of carbon elements in the SiC substrate exposed from the window by performing a heat treatment for the SiC substrate, and making the linear structure into a heat conductor.

14. The method of manufacturing a semiconductor device according to claim 13, wherein the heat treatment is performed at a substrate temperature of 1200℃ or more to 2000℃ or less in either of an oxygen atmosphere and a reduced pressure atmosphere.

15. The method of manufacturing a semiconductor device according to claim 13, wherein the mask film is decomposed and a film thickness thereof is reduced by the heat treatment.

16. The method of manufacturing a semiconductor device according to claim 15, wherein a silicon nitride film is formed as the mask film.

17. The method of manufacturing a semiconductor device according to claim 13, wherein a film is formed on an other surface of the SiC substrate after stopping a growth of the linear structure at midpoint depth of the SiC substrate.

18. The method of manufacturing a semiconductor device according to claim 17, wherein a semiconductor film is formed as the film.

19. The method of manufacturing a semiconductor device according to claim 17, further comprising:

forming a hole with a depth reaching the heat conductor in the film and the SiC substrate; and

forming an electrode electrically connected to the heat conductor in the hole.

20. The method of manufacturing a semiconductor device according to claim 13, wherein the heat treatment is performed before forming an element on the SiC substrate.

21. A method of manufacturing a semiconductor device comprising:

forming a first mask including a first window on one surface of a SiC substrate;

selectively growing a linear structure of carbon elements in the SiC substrate exposed from the first window by performing a first heat treatment for the SiC substrate, and making the linear structure into a first heat conductor;

forming a second mask film on the surface of the SiC substrate and the first heat conductor, from which the first mask film is removed, the second mask film including a second window at a portion spaced from the first heat conductor; and

selectively growing a linear structure of the carbon elements in the SiC substrate exposed from the second window by performing a second heat treatment for the SiC substrate, and making the linear structure into a second heat conductor.

22. A method of manufacturing a semiconductor device comprising:

forming a mask film including a window on a surface of a SiC substrate;

selectively growing a linear structure of carbon elements in the SiC substrate by performing a first heat treatment for the SiC substrate, and making the linear structure into a first heat conductor; and

growing a linear structure of the carbon elements on the entire surface of the SiC substrate by performing a

second heat treatment for the SiC substrate from which the mask film is removed, and making the linear structure into a second heat conductor.

23. A method of manufacturing a semiconductor device comprising:

forming a mask film including a window on a surface of a SiC substrate;

selectively growing a linear structure of carbon elements in the SiC substrate exposed from the window to midpoint depth of the SiC substrate by performing a heat treatment for the SiC substrate, and making the linear structure into a heat conductor; and

polishing the SiC substrate from an other surface to expose a surface of the heat conductor.

24. The method of manufacturing a semiconductor device according to claim 23, further comprising:

forming a protective film exposed on the one surface of the SiC substrate; and

forming a film on the protective film.

25. The method of manufacturing a semiconductor device according to claim 24, wherein the film is formed by a MOCVD method of enhanced lateral overgrowth.

26. The method of manufacturing a semiconductor device according to claim 24, wherein, as the protective film, a film having a lattice constant between lattice constants of the SiC substrate and the film is formed.

27. The method of manufacturing a semiconductor

device according to claim 24, further comprising:

forming a hole with a depth reaching the heat conductor in the film and the protective film; and

forming an electrode electrically connected to the heat conductor in the hole.

28. A method of manufacturing a semiconductor device comprising:

forming a hole in one surface of a semiconductor substrate;

selectively growing a linear structure of carbon in the hole, and making the linear structure into a heat conductor; and

polishing the semiconductor substrate from an other surface to expose a surface of the heat conductor.

29. The method of manufacturing a semiconductor device according to claim 28, wherein the linear structure of carbon is grown by a chemical vapor deposition method.